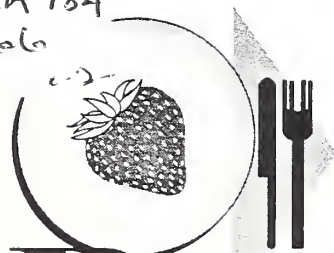


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# Food & Nutrition Research Briefs

## Can Antioxidant Foods Forestall Aging?

Foods that score high in an antioxidant assay called ORAC may protect cells and their components from damage by oxygen radicals, according to studies of animals and human blood. ORAC measures the total antioxidant power of foods and other chemical substances. Early findings suggest that eating plenty of high-ORAC fruits and vegetables—such as spinach and blueberries—may help slow the processes associated with aging in both body and brain.

Two human studies show that eating high-ORAC fruits and vegetables or simply doubling intake of fruits and vegetables—both naturally high in antioxidants—raises the antioxidant power of the blood between 13 and 25 percent. The studies are published in *the Journal of Nutrition* (vol. 128, pp. 2383-2390) and *the American Journal of Clinical Nutrition* (vol. 68, pp. 1081-1087).

Early evidence for the protective power of high-ORAC foods comes from rat studies. Rats fed daily doses of blueberry extract for six weeks before being subjected to pure oxygen suffered much less damage to the capillaries in and around their lungs.

**TOP ANTIOXIDANT FOODS**  
[ORAC\* units per 100 grams\*\*]

Fruits		Vegetables	
Prunes	5770	Kale	1770
Raisins	2830	Spinach	1260
Blueberries	2400	Brussels sprouts	980
Blackberries	2036	Alfalfa sprouts	930
Strawberries	1540	Broccoli florets	890
Raspberries	1220	Beets	840
Plums	949	Red bell peppers	710
Oranges	750	Onions	450
Red grapes	739	Corn	400
Cherries	670	Eggplant	390

\* Oxygen Radical Absorbance Capacity

\*\* About 3.5 ounces

In other tests, middle-aged rats were fed diets fortified with spinach or strawberry extract or vitamin E for nine months. A daily dose of spinach extract prevented some loss of long-term memory and learning ability normally experienced by

15-month-old rats. Spinach also proved most potent in protecting different types of nerve cells in two separate parts of the brain against the effects of aging, the researchers reported in the *Journal of Neuroscience* (vol. 18, pp. 8047-8055).

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## Some Starchy Foods Trigger Overeating

Ever wonder why you feel hungry a few hours after eating a big meal? Chances are you ate carbohydrate-containing foods that caused a rapid spike in your blood sugar. This musters extra insulin into the blood. The high insulin, in turn, makes blood sugar crash and suppresses the fat fuels as well. As a result, you get that famished feeling that leads to overeating.

That's what happened in a study of obese teenage boys by researchers at Children's Hospital in Boston and the USDA center in Boston. It's the first solid evidence that carbohydrates with a high glycemic index (GI)—those that are rapidly digested and absorbed—contribute to obesity.

On three separate days at least a week apart, researchers fed the boys breakfast and lunch having either a high, medium or low glycemic index. The boys ate almost twice as much after the high-GI meals compared to the low-GI fare. The high-GI meals induced a sequence of hormonal and metabolic changes that promoted overeating, the researchers reported in the electronic edition of *Pediatrics* at: <http://www.pediatrics.org/cgi/content/full/103/3/e26>. They suspect the findings apply to the middle-aged and elderly as well. About one-fifth of U.S. children and one-third of adults are now significantly overweight, despite a significant drop in fat intake over recent years.

Most starchy foods commonly eaten in North America, chiefly refined grain products and potatoes, have a high GI. Moreover, many of the low-fat foods that have flooded grocery shelves are also high in calories. Some starchy foods have GI's up to 50 percent higher than table sugar.

Sources of concentrated sugars, such as sodas and fruit juices, also have a high GI. By contrast, vegetables, legumes and fruits generally have a low GI.

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## Boosted Production of Anti-Cancer Drug

Taxol, a powerful but expensive anti-cancer drug, could become more plentiful in the future. Researchers have vastly improved the process for producing taxol in cell culture. The new process is 100 times more productive than the original cell-culture technique patented by ARS in 1991. Taxol is a potent chemotherapy drug for breast, ovarian, lung and other cancers. But it takes about 6,700 pounds of bark from increasingly scarce Pacific yew trees to produce a pound of the taxol drug.

Researchers with ARS, Washington State University and Cornell Research Foundation, Inc., screened some 2,000 cell lines from all five known yew species and found about 20 that are good taxol producers. They also optimized the growth media and other culture conditions for these top producers, they report in *Biotechnology and Bioengineering* (vol. 62, pp. 97-105). Their efforts increased taxol output from about 1 milligram per liter to more than 100 mg/L. The cultures also produce some taxol-related compounds, called taxanes, that can be converted to the drug in a semi-synthetic process.

ARS has applied for patent protection on the new process. If use of this new source of taxol is approved by the U.S. Food and Drug Administration and proves medically effective, anti-cancer drugs based on the process could be available within a few years.

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## Rapid Test for a Shifty Salmonella

Now there's a technique to rapidly detect DT104, a potentially deadly strain of *Salmonella* bacteria that resists many antibiotics. ARS researchers found a key gene sequence, present in this virulent strain of *Salmonella typhimurium*, that allows for quick identification. The new technique cuts identification time from six weeks to two hours. It means scientists can take samples, grow a culture, identify *Salmonella* DT104 and begin treatment in three to five days.

The sooner physicians know that they are dealing with DT104, the sooner they can begin the treatments needed to combat the bacteria. Delays in identifying DT104 almost cost a Vermont dairy farmer her life in 1997 and killed 14 of

her cows. The pathogen has killed people in Great Britain and sickened children in Nebraska.

The new technique opens the door to development of test kits. Such a kit might be able to detect the pathogen in blood samples or in runoff water from animal production.

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## Horseradish Too Hot for Food Pathogens

Some people love putting a dollop of horseradish on their steamy roast beef. As it turns out, this natural taste-maker may also be a useful food preservative. ARS studies show that both horseradish and mustard oil pack a punch against *Listeria monocytogenes*, *E. coli*, *Staphylococcus aureus* and other food pathogens you definitely don't want in your sandwich.

That's because these condiments contain a pungent chemical with the unsavory name of allyl isothiocyanate (AITC). Mustard oil is 93 percent AITC but has a milder flavor than horseradish, which is 60 percent AITC, researchers reported in the *Journal of Food Science* (vol. 63, pp. 621-624).

In 1989, USDA issued a "zero tolerance" policy for *L. monocytogenes*. But consumers now demand that foods rely less on artificial preservatives. This research fits in with the trend of seeking natural substitutes for chemical preservatives in the food industry. If this work is borne out in further research, horseradish and mustard oil could join the natural arsenal against malevolent microbes.

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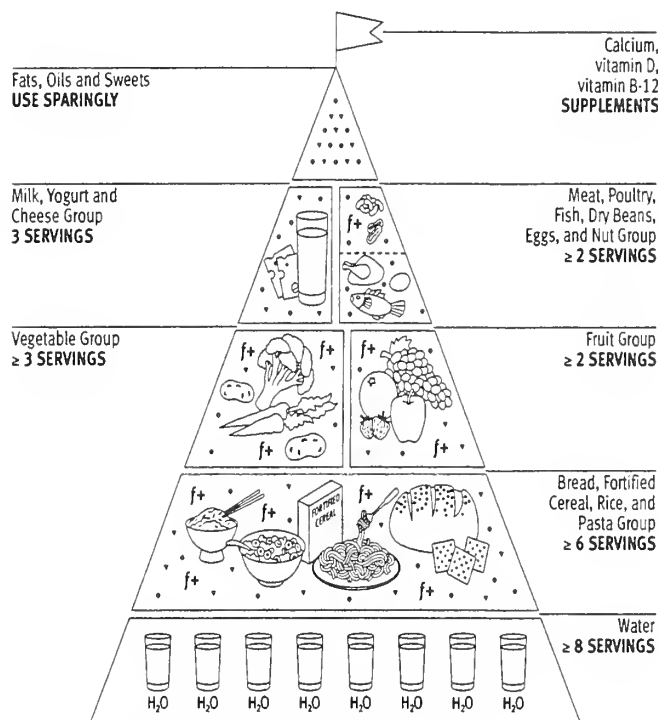
## Food Pyramid for the 70+ Generation

Recognizing that the elderly need fewer calories than younger Americans, researchers have modified USDA's Food Guide Pyramid for the over-70 generation, hoping to optimize their nutrient intake. Published in the *Journal of Nutrition* (vol. 129, pp. 751-753), the modified pyramid emphasizes nutrient-dense foods, fiber and water and recognizes a possible need for supplements. Its base is narrower than the original pyramid to reflect the decrease in energy (calorie) needs. And it rests on a new base accenting the elderly's need for fluids—at least 2 quarts, or 8 cups, of water per day. Older people often have a reduced sense of thirst, and that can lead to dehydration.

A fiber icon is scattered throughout to emphasize the need for a high-fiber diet. The food groups and recommended servings are the same as in the original pyramid with more



## Modified Food Pyramid for 70+ Adults



● **Fat** (naturally occurring and added)

▼ **Sugars** (added)

f+ **Fiber** (should be present)

These symbols show fat, added sugars, and fiber in foods

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emphasis on nutrient density and fiber. The researchers recommend that elderly consumers choose foods from the bread and cereal group that are whole-grain, enriched or fortified. Preferred vegetables are dark green, orange or yellow, which contribute vitamin C, vitamin A and folic acid, and the crucifers, such as beets, kale, cabbage and broccoli—all rich in antioxidants. Fruits should be yellow, orange or red, and the whole food is preferable to fruit juice. The researchers also recommend that dairy products be low fat.

A flag at the top of the pyramid reminds older people that they may need to add supplements of calcium, vitamin D and vitamin B<sub>12</sub> to bring daily intakes up to recommended levels. Those who exclude dairy products because of lactose intolerance, for instance, may need extra calcium. If sun exposure is minimal, a vitamin D supplement might be in order. And a vitamin B<sub>12</sub> supplement may be necessary because many elderly don't efficiently absorb the vitamin from meat and other foods.

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## Safer Salad in the Bag

Irradiating bagged salads after washing the vegetables in a chlorine solution reduces harmful and harmless microorganisms without affecting quality, studies show. And the irradiated lettuce has about the same shelf life as untreated samples. That's good news for health-conscious consumers who are eating more salads. U.S. sales of packaged lettuce alone were more than \$1.2 billion in 1997.

A chlorine wash doesn't eliminate all the organisms that can be present on fresh-cut lettuce, like *Shigella* and *E. coli* O157:H7. This combination treatment could help fresh-cut salads to be included in diets of people with weakened immune systems who otherwise can't enjoy them.

Irradiation significantly reduced the microbial and yeast populations. Eight days after zapping chlorine-washed lettuce with only 0.2 kilogray (kGy) of irradiation, microbial counts were 290 colony-forming units (CFU) and 60 CFU of yeast. That's compared to counts of 220,000 CFU and 1,400 CFU of yeast on nonirradiated lettuce, the researchers published in the *Journal of Agricultural and Food Chemistry* (vol. 45, pp. 2864-2868). The U.S. Food and Drug Administration has approved up to 1 kGy of irradiation for fresh produce.

Scientists also irradiated chlorine-washed, shredded carrots in modified-atmosphere packaging. Nine days after irradiation, on the expiration date, microbial count was 1,300, compared with 87,000 for nonirradiated, chlorinated control samples, as reported in the *Journal of Food Science* (vol. 65, pp. 162-164).

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## Snapshot of U.S. Homocysteine Levels

A profile of U.S. blood homocysteine levels confirms findings of earlier, nonrepresentative studies: This recently recognized risk factor for heart disease increases with age and is higher in males than females. Homocysteine is produced during the conversion of one amino acid into another. Incomplete conversion causes a buildup of homocysteine in the blood where it is thought to irritate artery linings, encouraging formation of plaque—fatty deposits that cling to artery walls.

Researchers with the USDA center in Boston used sera from the latest National Health and Nutrition Examination Survey to measure homocysteine for 3,766 males and 4,819 females from age 12 up. Homocysteine levels between the two genders were closest in the young and old, diverging around puberty and converging after menopause. Researchers with the Centers for Disease Control and Prevention collaborated

on the study, published in the *American Journal of Clinical Nutrition* (vol. 69, pp. 482-489).

One unexpected finding: Mexican-American females had the lowest homocysteine levels. The researchers don't have an explanation for this finding yet. As for higher homocysteine levels in older people, they suspect impaired kidney function may contribute. And the difference between genders may be due to body size, estrogen and vitamin status.

Low intake of folate, vitamin B<sub>12</sub> or vitamin B<sub>6</sub> can be a cause for the homocysteine buildup. Orange juice and green leafy vegetables are good sources of folate, which seems the most limiting of the three vitamins.

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## A Healthy Change for the Delta

A consortium called the Delta Nutrition Intervention Research Initiative promises to help low-income families of the lower Mississippi Delta eat better food and lead healthier lives. Delta NIRI involves poor Delta communities in deciding what their key nutrition problems are and empowers them to find solutions, with help from nutrition scientists.

Compared to national statistics, Delta families are more likely to lack prenatal care, have low-birth-weight newborns and high infant mortality. Nutrition-related chronic diseases such as hypertension, cardiovascular disease and diabetes are also above national averages.

Coordinated by ARS, Delta NIRI serves 36 counties or parishes in Louisiana, Mississippi and Arkansas. Its members include seven nutritional research centers in those states. Begun in 1995, Delta NIRI has an operating budget of \$3.1 million for 1999. The consortium hires and trains Delta residents to survey area counties about health and

nutrition problems. Then researchers in the Delta NIRI program design and test nutrition interventions based on these concerns. Ultimately, the community decides if the programs are worthwhile and should continue.

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## A Good Idea During Pregnancy

Getting enough copper during pregnancy may be important for Baby's brain development, according to a study of newborn rat pups. Slashing the mother rats' copper intake during pregnancy and nursing reduced the pups' brain levels of the enzyme PKC, important to development of the nervous system. The findings may have implications for people in the U.S. and other industrialized nations where copper intake is less than desirable.

Throughout pregnancy and afterward, one group of rat mothers got only 1 microgram (mcg) of copper daily—one-sixth the level recommended for pregnant rats. A second group got 2 mcg and a control group got all they needed. PKC increased in all the pups' brains during the three weeks after birth. But compared to the control group, the increase was only about half as much in the group whose moms got 1 mcg of copper.

Pups from the 2-mcg group also had a smaller increase—25 percent less overall—with one form of PKC lagging by 50 percent in the cerebellum, which controls motor function. This is significant because poor muscle coordination is a well-known symptom of copper deficiency in baby animals.

The brain has several enzymes that would suffer from a shortage of copper. Some contain copper. Others, like PKC, don't contain it but are less active in its absence. Between 1.5 and 3 milligrams of copper daily is currently suggested for all adults. The richest sources of copper are oysters, liver and cocoa. Whole grains, nuts and seeds are good sources.

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